NRC 2003-0084 10 CFR 50.73

September 12, 2003

U S Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

POINT BEACH NUCLEAR PLANT, UNIT 1
DOCKET 50-266
LER 266/2003-002-00; UNIT 1-REACTOR TRIP DUE TO
ROD DRIVE MOTOR-GENERATOR SET FAILURE

Enclosed is Licensee Event Report (LER) 266/2003-002-00 for the Point Beach Nuclear Plant, Unit 1. The subject condition was determined to be reportable under 10 CFR 50.73(a)(2)(iv) as; " Any event or condition that resulted in manual or automatic actuation of any of the systems listed in paragraph (a)(2)(iv)(B) of this section". This LER discusses an equipment failure in a motor generator set for the control rod drive system which resulted in an automatic trip of the PBNP Unit 1 reactor from 100% power.

Corrective actions, completed and proposed, have been identified in the enclosed report. There are no new commitments in this report.

Please contact us if you have any questions or require additional information concerning this report.

A.J. Cayia
Site Vice President, Point Beach Nuclear Plant

cc: Regional Administrator, USNRC, Region III
Project Manager, Point Beach Nuclear Power Plant, USNRC, NRR
NRC Resident Inspector – Point Beach Nuclear Power Plant
PSCW

Enclosure

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NRC FORM 366 (7-2001) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 7-31-2004

Estimated burden per response to comply with this mandatory information collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records Management Branch (T-6 E6), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to bjs1@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202 (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

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TITLE (4)
REACTOR TRIP DUE TO ROD DRIVE MOTOR-GENERATOR SET FAILURE

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
07	15	03	2003	– 002	– 00	09	12	03	None	
									FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply) (11)					
POWER LEVEL (10)	100	20.2201(b)	20.2203(a)(3)(ii)		50.73(a)(2)(ii)(B)		50.73(a)(2)(ix)(A)
		20.2201(d)	20.2203(a)(4)		50.73(a)(2)(iii)		50.73(a)(2)(x)
		20.2203(a)(1)	50.36(c)(1)(i)(A)	X	50.73(a)(2)(iv)(A)		73.71(a)(4)
		20.2203(a)(2)(i)	50.36(c)(1)(ii)(A)		50.73(a)(2)(v)(A)		73.71(a)(5)
		[redacted]	50.36(c)(2)		[redacted]		OTHER
		[redacted]	50.46(a)(3)(ii)		[redacted]		Specify in Abstract below or in NRC Form 366A
		20.2203(a)(2)(iv)	[redacted]		[redacted]		
		[redacted]	[redacted]		50.73(a)(2)(vii)		
		[redacted]	[redacted]		50.73(a)(2)(viii)(A)		
		[redacted]	[redacted]		[redacted]		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Charles Wm. Krause, Senior Regulatory Compliance Engineer	(920) 755-6809

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX		CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
X	AA	MG	W120	Y						

SUPPLEMENTAL REPORT EXPECTED (14)				EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
	YES (If yes, complete EXPECTED SUBMISSION DATE).	X	NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On July 15, 2003, at approximately 1340 CDT, Point Beach Nuclear Plant (PBNP) Unit 1 experienced an automatic reactor trip from full power followed by a loss of Feedwater/Turbine Trip due to the reactor trip and main feedwater regulating valve closure. The cause of the trip was a failure of the 1G-06 Control Rod Drive Motor Generator set. The first out indication for the trip was an over temperature delta T signal. This trip also resulted in an automatic actuation of the Auxiliary Feedwater System. An operator was dispatched to the Unit 1 Rod Drive Room and identified smoke coming from the Voltage Regulator cabinets. Actions were taken to de-energize both Rod Drive Motor Generator (MG) Sets. Operators continued with follow-up actions to stabilize the unit in Mode 3. An event notification (EN# 39996) was made to the NRC at 1429 CDT.

An investigation concluded that the voltage regulator failure was caused by the failure of a surge suppressor component in the power and feedback circuit. The 1G-06 MG set was repaired and a modification to the circuitry to improve voltage regulator reliability was completed in both the 1G-06 and 1G-07 motor generator sets. Systems and equipment necessary to mitigate the consequences of this equipment failure and subsequent reactor trip functioned as designed and the plant was maintained in a stable hot shutdown condition during the troubleshooting and repair of 1G-06. The safety and welfare of the public and the plant staff was not impacted by this event and the safety significance was minimal.

Event Description:

On July 15, 2003, Point Beach Nuclear Plant (PBNP) Unit 1 was in full power operation. At approximately 1339 (all times are Central Daylight Time) Operators received a "D-07 Battery Charger Trouble" alarm[1] and shortly thereafter Unit 1 "Rod Control Urgent" and "Rod Control Non-Urgent" Alarms[2]. Operators immediately referenced the alarm response procedures, however, at 1340, a Unit 1 automatic reactor trip occurred followed by a loss of Feedwater/Turbine Trip due to the reactor trip and Main Feedwater Regulating Valve[3] closure. Control Room personnel entered Emergency Operating Procedure EOP-0, "Reactor Trip or Safety Injection" and transitioned to EOP 0.1 "Reactor Trip Response". At 1343, an auxiliary operator, previously dispatched to the Unit 1 Rod Drive Room[4], reported that there was smoke coming from the Rod Drive Motor Generator (MG) Set[5]. At 1347, both the 1G-06 and 1G-07 Rod Drive MG Sets were de-energized by opening the supply breakers[6] per procedure OI-31. At 1355, it was reported to the control room, that the 1G-06 Voltage Regulator[7] showed signs of overheating on the fuses and wiring and at 1412, the DC feed breaker to the Voltage Regulator was opened which cleared the "D-07 Trouble" and "DC Ground Fault" alarms.

At 1429, an event notification (EN# 39996) was made to the NRC Operations Center via the Emergency Notification System. At 1755, a shutdown margin calculation was performed and verified satisfactorily that the unit was stable in Mode 3. Systems and equipment necessary to mitigate the consequences of this equipment failure and subsequent reactor trip functioned as designed and the plant was maintained in a stable hot shutdown condition during the troubleshooting and repair of 1G06.

Following completion of the initial review of the event and completion of interim corrective actions, Unit 1 restart was authorized. On July 24, a Unit 1 reactor startup commenced and the reactor was critical at 1110. On July 25, 2003 at 1110, full power operation was achieved.

Event Analysis:

A root cause evaluation team was appointed to determine the cause of the failure of 1G-06, and to assess the vulnerability of 1G-07 and the PBNP Unit 2 rod drive motor generators to the same failure mechanisms. Investigation revealed that the 1G-06 Voltage Regulator failed due to a failure of an internal component denoted on plant drawings as VOLTRAP SP1, which acts as a surge suppressor in the voltage regulator power and feedback circuit. This failure caused the voltage regulator to draw high current from transformer 2T overloading the transformer. Overloading

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[1] EIIS System Identifier: EJ Component Identifier: ALM
[2] EIIS System Identifier: JD Component Identifier: ALM
[3] EIIS System Identifier: SJ Component Identifier: FCV
[4] EIIS System Identifier: VI
[5] EIIS System Identifier: JD Component Identifier: MO/GEN
[6] Component Identifier: BKR
[7] Component Identifier: 90

transformer 2T caused it to burn, melt and eventually fault the primary windings causing a fault on the 260VAC bus supplying the Control Rod Drive Mechanisms (CRDMs).

The failure of the 1G-06 voltage regulator also caused a loss of excitation to the 1G-06 generator. The 1G-06 output breaker did not open and 1G-06 continued to operate in parallel with 1G-07. As a result, 1G-07 began to feed large circulating currents to the 1G-06 generator (i.e. 1G-06 became a large inductive load on 1G-07). In addition, the real loading on 1G-07 increased rapidly due to the CRDM load previously shared with 1G-06. It is also believed that 1G-07 was still feeding the faulted transformer 2T. The result of each of these loads on 1G-07 caused the bus voltage to drop significantly, eventually causing control rods to fall and CRDM power supplies to fail.

The failure associated with the 1G-06 MG set voltage regulator was reviewed to determine if 1G-07, 2G-06 or 2G-07 were susceptible to a similar failure. It was determined that they are susceptible, and the same actions taken to modify 1G-06 were taken on 1G-07 via modification MR 03-031. The Unit 2 Rod Drive MG set voltage regulators will be inspected during the fall 2003 refueling outage. There are no other voltage regulators of this type in use at PBNP thus limiting the extent of condition review to the Rod Drive MG set components.

This event is being reported in accordance with 10 CFR 50.73(a)(2)(iv) System Actuation; " Any event or condition that resulted in manual or automatic actuation of any of the systems listed in paragraph (a)(2)(iv)(B) of this section".

Cause:

As discussed in the Event Analysis, the root cause of this event was the failure of the VOLTRAP SP1 component internal to the 1G-06 Voltage Regulator. This caused a high current from transformer 2T to overload the transformer. Overloading transformer 2T caused it to burn, melt and eventually fault the primary windings causing a fault on the 260VAC bus supplying the CRDMs. A contributing cause was the fact that the voltmeters and ammeters on the cabinet doors used to balance loads between MG sets were out of tolerance. As a result , when loads were balanced in accordance with plant procedures, circulating currents between the MG sets were created which imposed additional stress on the components.

Corrective Actions:

Work orders were implemented to trouble shoot and repair 1G-06 and 1G-07. These actions were completed before returning Unit 1 to power operations. Repairs included installation of an equipment modification (MR 03-031) to provide more reliable voltage regulation of the MG sets. The modifications included relocating the 2T transformer and installing fuses on the primary side of the transformer that provides input into the generator field regulating circuit.

The Unit 2 Rod Drive MG sets will be inspected and evaluated during the Fall 2003 refueling outage to determine whether modifications similar to those completed on Unit 1 are necessary.

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NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)* (17)

Safety Significance:

With the exception of the failure of the 1G-06 MG set, which initiated this event, the plant response during and following this reactor trip and AFW actuation was as expected. Systems and equipment necessary to mitigate the consequences of this transient performed as designed and maintained the plant in a stable hot shutdown condition. Although this was an actuation of the reactor protection system and other plant equipment necessary to remove shutdown decay heat and maintain the plant in a stable configuration, the safety significance of this event was minimal. The safety and welfare of the public and the plant staff was not impacted by this event.

During this event and the subsequent recovery actions there was at no time a loss of a system, structure, or component related safety functions; therefore, this event did not involve a Safety System Functional Failure.

Similar Occurrences:

A review of LERs submitted in the past three years identified the following events which involved a reactor trip due to equipment fault or failure:

LER NUMBER	Title
301/2003-004-00	Reactor Trip Due to Failure of "B" Main Feedwater Pump
301/2001-001-00	Ground Fault Relay Actuation Causes Generator Lockout and Reactor Trip
301/2000-007-00	Fault Associated with "C" Phase Main Step-up Transformer Results in Reactor Scram
301/2000-006-00	Failed Fuse in Intermediate Range Nuclear Detector Results in Reactor Scram